SECTION 661
TRAFFIC SIGNS AND DELINEATORS

661.1-DESCRIPTION:

This item shall consist of the fabricating, furnishing, and erecting of a complete system of traffic signs and delineators in accordance with the requirements of the Plans and of these specifications. All details not specified or not shown on the Plans shall conform to the details and requirements set forth in the following specifications and publications:

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, latest issue, including revisions, American Association of State Highway and Transportation Officials (AASHTO).

Manual on Uniform Traffic Control Devices for Streets and Highways, latest issue, including revisions, as printed by the Federal Highway Administration, U.S. Department of Transportation. (Referred to as the MUTCD).

Standard Alphabets for Highway Signs, as printed by the Federal Highway Administration, U.S. Department of Transportation. *West Virginia Manual of Uniform Traffic Control Devices, Fabrication Details*, latest issue, including revisions. (Referred to as the Fabrication Manual).

661.2-MATERIALS:

The criteria for sampling, inspection, and acceptance of signing material are documented in MP 661.02.40.

661.2.1-Aluminum:

661.2.1.1-Sign Panels: Panels shall be of the type specified in the Plans and shall meet the following Specifications:

661.2.1.1.1-Sheets: Aluminum for sheet sign panels shall be Alloy 6061-T6, ASTM B 209 or Alloy 5052-H38, and shall meet the ASD fabrication requirements for mill products. For signs using porcelain enamel background on sheet aluminum, the Contractor shall use an alloy which has been recommended by the manufacturer and approved by the Engineer, specially designed and prepared for the application of porcelain enamel.

661.2.1.1.2-Extrusions: Aluminum for the extruded panels shall be Alloy 6063-T6, ASTM B 221.

661.2.1.2-Structural Shapes: Structural shapes, rolled or extruded, used for sign framing or mounting brackets shall be of Alloy 6061-T6 or Alloy 6063-T6, ASTM B 211 or B221.

661.2.1.3-Hardware: Aluminum for hex lock nuts for use with post clip bolts and stitch bolts shall conform to Aluminum Alloy 2017-T4. Lock nuts

shall have anodic coating conforming to MIL-A-8625. Thread fit shall be as recommended by the manufacturer.

Flat washers for use with stitch bolts and post clip bolts shallconform to current ASTM B 209, aluminum alloy 2024-T4 or Alclad 2024-T4. Washers shall be used with all lock nuts and stitch bolts.

Spring, lock-washers shall conform to current ASTM B 211, Alloy 7075-T6, aluminum alloy bars, rods and wire.

Post clips shall conform to current ASTM B 108, Alloy 356-T6, aluminum base alloy permanent mold castings.

Post clip bolts and stitch bolts shall conform to current ASTM B 211, Alloy 2024-T4, aluminum alloy bars, rods and wire. Bolts shall have an anodic coating and shall be chromate sealed in accordance with MIL-A-8625.

Nuts, ¼ in. (6 mm) top and under, and all bolts and machine screws shall be made from Alloy 2024-T4, ASTM B 211. Nuts 5/16 in. (8 mm) and over, shall be Alloy 6262-T9, ASTM B 211. All nuts, bolts and machine screws shall have an anodic coating with a chromate seal conforming to MIL-A-8625.

U-bolts shall be fabricated of 2024-T4 aluminum alloy conforming to ASTM B 211 and connecting clips shall be fabricated of 6061-T6 aluminum alloy conforming to ASTM B 221.

661.2.1.4-Demountable Copy: Demountable copy, including all items of legend and border, shall be fabricated of aluminum 0.040 in. (1 mm) thick sheet conforming to ASTM B 209, Alloy 5052 H38.

Demountable copy shall be coated with white type II high-intensity sheeting unless another color is specified on the Plans.

Demountable legend shall be in accordance with the current MUTCD. Combined upper and lower case alphabets shall be Series E modified by widening the stroke width to approximately one-fifth of the letter or numeral height of the upper case alphabet. Capital alphabets shall be Series D modified by widening the stroke width to approximately one-fifth of the letter or numeral height.

661.2.1.5-Rivets: All rivets used for the attachment of demountable copy shall be blind, dome head, self-plugging or pull through type mandrel, made of aluminum alloy that will not produce streaking or discoloring of the sign face. The manufacturer of the rivets shall determine the method of rivet application.

All rivets used for the attachment of delineators shall be blind, dome head, self-plugging or pull through type mandrel. Therivets shall be an aluminum alloy.

661.2.2-Steel: Hardware-Low carbon steel bolts and nuts shall be in accordance with ASTM A 307. Manufacturer's markingson A 307 bolts will not be required. High strength steel bolts, nuts, and washers shall be in accordance with ASTM A 325. Stainless steel bolting materials shall be in accordance with ASTM A 320 and shall be of the type recommended by the

manufacturer of the material. Galvanizing, if required, should conform to ASTM A 153. Cadmium plating, if required, should conform to ASTM B 766, Class 12 (0.47 mils) (12 µm).

Material used for banding and buckles, clamps, bolts, and lockwashers shall be stainless steel.

Steel clamps for attaching sign to tubular supports shall be of two types. Type I, a light duty clamp shall be capable of withstanding loads equivalent to a sign area of 20 sq. ft. (2 sq. m) and shall be fabricated from material meeting the requirements of ASTM A 575 of A 576, Grade 1020. Type II, a heavy duty clamp, shall be capable of withstanding the loads equivalent to a sign area of 80 sq. ft. (7.5 sq. m) and shall be fabricated from material conforming to the requirements of ASTM A606, A607 or ASTM A242.

Steel shapes and plates used as mounting hardware or as sign framing shall be Grade 1020 conforming to ASTM A 575 or A 576.

Steel for delineator supporting brackets shall be commercial quality steel galvanized in accordance with ASTM A 123.

661.2.3-Enclosed Lens Reflective Sheeting: The reflective sheeting shall conform to 715.9.2.1.

661.2.4-Reflex Reflectors: The reflectors shall conform to 715.9.2.4.

661.2.5-Delineators: A delineator shall consist of one reflective unit of the color required, assembled separately or in groups of two or three, on steel flanged channel bar post, or on metal brackets in accordance with Standard Drawings and the following Specifications:

661.2.5.1-Reflex Reflector: Single reflective units shall be a minimum of 3 inches (75 mm) in diameter. A unit shall consist of a reflex reflector andan 0.020-inch (508 µm) thick aluminum housing conforming to ASTM B-209, Alloy 5052, with one center-mount hole for attachment to the support.

Reflective units shall be attached to the posts or brackets with aluminum rivets.

The reflector shall consist of a clear and transparent plastic face, with

seven square inches (4 500 sq. mm) of reflective area, referred to as the lens with a heat sealable plastic coated metallic foil back fused to the lens under heat and pressure around the entire perimeter of the lens and the central mounting hole to form a unit permanently sealed against dust, water, and water vapor.

Specific Intensity-The specific intensity of each reflector intended for use in delineators shall be equal to or exceed the following minimum values, with measurements made with the reflector spinning. Failure to meet the specific intensity minimum shall constitute failure of the reflector being tested; failure of more than two reflectors out of fifty subjected to test shall constitute failure of the lot.

Observation Angle (Degrees)	Entrance Angle (Degrees)	Specific Intensity (Candlepower/Footcandle)	
		White	Amber
0.1	0	119	71
0.1	20	47	28

Test procedure shall be in accordance with MP 107.07.21.

661.2.5.2-Encapsulated Lens: Single reflective units shall be 4 by 4 inches (100 mm by 100 mm). A unit shall consist of silver or yellow encapsulated sheeting permanently adhered to a flat sheet aluminum (Alloy 6061-T6, ASTM B 209 or Alloy 5052-H38) 0.080 inches (2.03 mm) thick with one center-mount hole for attachment to the support. The flat sheet aluminum shall be prepared in accordance with 661.3.4.

Reflective units shall be attached to the posts of brackets with aluminum rivets.

The reflective material shall conform to the requirements of 661.2.10.

Prior to manufacture and fabrication, a sample of each type of delineator assembly shall be submitted by the Contractor to the Engineer for written approval, if delineator assemblies are not similar to those shown on the Plans.

661.2.5.3-Three Unit Delineators: The three unit delineator shall consist of three reflex reflector delineators (661.2.5.1) riveted to a 6 x 15-inch (150 by 375 mm) aluminum sheet (Alloy 6061-T6, ASTM B 209 or Alloy 5052-H38) of 0.125-inch (3.18 mm) thickness. The aluminum sheet shall be primed with high quality synthetic baking primer and enameled with yellow enamel.

661.2.5.4-Nine Unit Delineators: The nine unit delineator shall consist of reflex reflector delineators (661.2.5.1) riveted to a 18 x 18-inch (450 by 450 mm) aluminum sheet (Alloy 6061-T6, ASTM B 209 or Alloy 5052-H38) of 0.125-inch (450 by 450 mm) thickness. The aluminum sheet shall be primed with high quality synthetic baking primer and enameled with yellow enamel.

661.2.6-Inks: Inks for reflective sheeting shall meet the requirements of Section 711.13.

661.2.7-Nylon Washers: Nylon washers shall be of commercial grade.

661.2.8-Route Markers for Guide Signs: Route marker shields to be mounted on guide signs shall be fabricated using aluminum alloy 6061-T6 or 5052-H38, ASTM B209. The minimum thickness of the aluminum sheet shall be 0.040 inches (1.02 mm). All shields shall be attached to the guide signs using

661.2.8.1
approved rivets.

661.2.8.1-Reflective Guide Signs: U.S. and State route marker shields shall have white encapsulated lens, reflective sheeting background, with black nonreflective sheeting numerals.

Interstate shields shall have red and blue encapsulated lens, reflective sheeting background, with white numerals and border.

661.2.8.2-Blank

661.2.9-Nonreflective Sheeting: Nonreflective sheeting shall conform to the requirements of 715.9.2.2.

661.2.10-Encapsulated Lens Reflective Sheeting: The reflective sheeting shall conform to 715.9.2.3.

CONSTRUCTION METHODS

661.3-FABRICATION:

661.3.1-General: Fabrication of all sign parts shall be in accordance with the dimensions shown on the Plans and approved shop drawings. Work shall be done in a uniform workmanlike manner.

661.3.2-Shop Drawings: If not as shown on the Plans, the Contractor shall submit to the Engineer for approval scale drawings, eight copies, of those signs having variances, showing arrangement and spacing of all letters, symbols and borders for all signs having demountable legend, attachment of sign panels, and copies of all layout templates for silk screen signs.

If a method of attaching sign panels to supports is other than as shown on the Standard Drawings , the Contractor shall submit to the Engineer for approval detailed drawings, eight copies, showing the proposed method of attaching each type of sign panel to each type of support.

661.3.3-Metal Cutting and Refinishing: Panels one-half inch (13 mm) thick or less shall be cut by one of the following methods: sheared, blanked, sawed or milled. Panels over one-half inch (13 mm) thick shall be sawed or milled. Re-entrant cuts shall be filleted by drilling prior to cutting. No flame cutting will be permitted. Cut edges shall be refinished to present a true and smooth edge that is free from burrs and ragged breaks. Holes shall be made in such a manner as not to affect the finished surface.

661.3.4-Sign Panel Preparation: Prior to application of ink or reflective sheeting to the sign panels, they shall be given a chemical conversion treatment meeting the requirements of ASTM B449, Class 1 or 2.

All fabrication, including cutting, welding, riveting, and punching of holes

other than mounting holes for demountable letters, numerals, symbols and borders, shall be completed prior to surface preparation. However, it will be permissible to weld studs to panels after application of sheeting.

661.3.4.1 Through 661.3.4.3 -Blank

661.3.4.4-Handling: Sign panels shall not be handled, except by mechanical devices or clean canvas gloves, between all cleaning and etching operations and the application of reflective sheeting. There shall be no opportunity for metal to come in contact with grease, oils, or other contaminates after cleaning and etching and prior to the application of the background material.

661.3.5-Application of Reflective Sheeting: The application of reflective sheeting to the backing material shall be in full accordance with instructions of the manufacturer of the reflective sheeting used.

Reflective sheeting shall cover one entire side of the flat sheet blank, which side shall be the sign face. When applied to extruded sign panels, reflective sheeting shall be rolled over each edge of the extrusion ¼ in. (6.35 mm) (plus 1/16 in. (1.6 mm), minus 0 in. (mm)) to prevent an opened surface on the sign face.

Reflective sheeting shall be applied mechanically in a manner specified by the manufacturers of the reflective sheeting.

Signs 48 in. (1.2 m) and less on the shorter side shall be covered by a single piece of reflective sheeting. On signs larger than 48 in. (1.2 m), adjacent pieces shall be carefully matched for color to provide uniform reflective quality. All seams shall be straight and the edges of adjustment pieces shall be overlapped a minimum of 3/16 in. (5 mm) the length of the seam.

661.3.6-Application of Copy:

661.3.6.1-Demountable Copy: Each letter, symbol and border shall be supplied with mounting holes and shall be secured to the sign surface with approved rivets. The use of tape, glue or other substance to secure the copy to the sign face during fabrication or in its final form, other than approved rivets, will not be allowed.

Demountable letters, digits, borders and alphabet accessories shall be attached flush against sign faces after background material has been applied.

Spacing of all legends and borders shall be as specified with an allowable tolerance of plus or minus 2 percent on any individual measurement as shown on the Plans or approved shop drawings. A sufficient number of rivets shall be used to securely fasten demountable legends and borders to sign panels.

661.3.6.2-Screen Processing: All legends or borders on signs, except demountable letters or borders, shall be applied by screen processing, reverse

screen processing, or cut out letters after the reflective sheeting is applied to the panels. All screening shall be done in a workmanlike manner and as recommended by the manufacturer of the reflective sheeting. The Contractor may apply legends and borders to signs having reflectorized backgrounds by equally effective methods after approval of the Engineer. All legends, borders and backgrounds shall be of the color specified and placed on the sign as shown on the Plans.

The screening shall be done in a manner which results in a uniform color and tone, with sharply defined edges of legend and border and without blemishes on the sign background. Where screening is required, free hand painting will not be permitted. Proper size screen mesh shall be used in reverse screening to ascertain that the finished colors match the prescribed Standard Interstate Colors.

661.3.7-Sign Panels:

661.3.7.1-Flat Sheet: Flat sheet signs shall be fabricated of a single piece of sheet material without joints and without supporting frame. The height or width of the sign shall be within plus or minus ⅛ in. (3 mm) tolerance of the dimensions indicated on the Plans. Corner radii shall be within plus or minus 1/16 in. (1.6 mm) tolerance of the dimensions shown on the Plans.

The following minimum thickness shall be used for the appropriate width unless the height of the sign is less than half the width, in which case the next heavier gauge (up to 0.100 in. (2.54 mm)) shall be used. The width is measured perpendicular to the post.

{ENGLISH}

Width (Inches)	Thickness Based On	
	Single Post Mounting (Inches)	Two Post Mounting (Inches)
Up to 30 Inclusive	0.080	----
31 to 37 Inclusive	0.100	----
38 to 47 Inclusive	0.100	0.800
48 to 60 Inclusive	0.100	0.100
61 to 72 Inclusive	0.100	0.100

{METRIC}

Width (mm)	Thickness Based On	
	Single Post Mounting (mm)	Two Post Mounting (mm)
Up to 750 Inclusive	2.03	----
751 to 925 Inclusive	2.54	----
926 to 1 175 Inclusive	2.54	2.032
1 176 to 1 500 Inclusive	2.54	2.54
1 501 to 1 800 Inclusive	2.54	2.54

Panels shall have dimensions and corner radii in accordance with the Standard Drawings and shall be punched only with the holes necessary for proper mounting. Signs shall be free of buckles, warp, dents, and burrs prior to the application of reflective sheeting or other background material. Dimples or indentations shall not be noticeable from a distance of 10 feet (3 m) normal to the sign.

661.3.7.2-Extruded Panels: Extruded panel signs shall consist of extruded aluminum channel sections, bolted together at the flanges, to form a surface of the length, width, and depth required, to which the legend, border, and background have been applied.

The panel sections shall be of the shape, dimensions, and weight shown on the Standard Drawings. This section as shown is nominal and an alternate extruded panel section of equal or greater section modulus and having dimensions suitable to utilize hardware as shown on the Standard Drawings may be supplied by the Contractor upon receipt of the written approval of the Engineer. No splicing of sections will be permitted.

The sections shall be within the established commercial tolerances of the aluminum industry.

Each panel shall be flat and true within ¼ in. (6.35 mm) tolerance on an 8 ft. (2.4 m) length, with proportionately greater allowance on longer lengths. Flatness across the face of each panel shall be limited to 0.004 in. per inch (100 µm per 25.4 mm) of width.

The panels shall be assembled in the shop and firmly bolted to form a sign of the length and width required. Before bolting, the webs of the panels shall be in the same plane to form a smooth and uniform surface and the ends shall be free from projections. Adjacent panels shall be color matched both day and night.

It is intended that the sign shall be fabricated as a single unit. If the largest signs cannot be shipped as a single unit, they may be sectionalized as approved by the Engineer. All signs must be completely shop assembled but if field joining of panels is permitted, legend and border units which overlap the

joining must be removed and replaced in the field.

661.3.7.3-BLANK

661.3.7.4-Clear Coating and Edge Sealing: Signs to which reflective sheeting has been applied shall not be clear coated, except when it is recommended by the manufacturer of the sheeting. Edge sealer shall be applied to all splices and edges as recommended by the sheeting manufacturer.

661.3.7.5-Packaging: All signs shall be protected by packaging during shipment and storage. The packing shall be adequate to prevent damage to any part of the sign, including any demountable legends or borders. Before packaging, all signs shall be free of moisture and all paints shall be thoroughly dry. Adhesive tapes shall not be applied to any sign surfaces. All packaged signs shall be kept entirely dry.

Signs delivered for use on a project shall be stored off the ground and under cover in a manner meeting the approval of the Engineer.

Signs reflectorized with encapsulated lens sheeting shall be packaged and stored as specified, with careful consideration to avoid friction or rubbing between signs; shall be kept dry and at an ambient temperature not to exceed 150° F (66° C); and shall be stored on edge to prevent excessive pressure on the surface of the sheeting.

661.3.8-Application of Nonreflective Film: Nonreflective film shall be mechanically applied and processed in accordance with the recommendation of the film manufacturer.

Nonreflective sheeting shall be clear coated and force cured as recommended by the manufacturer of the sheeting.

661.4-ERECTION:

661.4.1-General: All signs and delineators shall be erected at the points designated on the Plans or by the Engineer in accordance with these Specifications and in reasonable close conformity to the locations, elevations and angles shown on the Plans or established by the Engineer.

Before starting the erection of signs, the Contractor shall establish the location of each sign in accordance with the Plans or as directed by the Engineer, and mark each sign site with construction stakes, having clearly indicated the sign number of the respective sign. The Contractor shall furnish stakes, paint, other materials and labor for performing the locating and staking as described. When the sites have been staked and are ready for inspection, the Contractor shall inform the Engineer, who will check and approve the site or make necessary changes. Centerline station information will be furnished to the Contractor by the Engineer.

The Contractor shall take full responsibility for checking all cross sections at approved sign locations to determine final support lengths. The supports

shall not be fabricated until such time as the above measurements prove acceptable to the Engineer. Upon approval of location and support length, the Contractor shall erect the proper sign at the staked location and complete all work.

After installation of the signs, they shall be inspected at night by the Engineer. If specular reflection is apparent on any sign, its positioning shall be adjusted by the Contractor at his expense to correct this condition.

661.4.2-Location of Ground Mounted Signs: Signs shall be oriented to minimize or eliminate specular reflection.

Ground mounted signs longer than 48 in. (1.2 m) shall normally be mounted at 93 degrees away from the direction of, and facing, the traffic that they are intended to serve.

On curves, structural posts shall be located and erected so as to face the sign at an angle of 85 degrees from the line of sight. The line of sight is defined as the line between the center of the sign and the centerline of the traffic lane adjacent to the sign. Its length in feet is equal to 50 (meters is equal to 0.6) times the letter height, in inches (mm), of the smallest legend in the major line of copy. (Example: 50 by 12 in. letter equals 600 ft. in the line of sight). (Example: 0.6 by 300 mm letter equals 180 meters in the line of sight).

Ground mounted signs shorter than 48 in. (1.2 m) shall normally be mounted approximately at right angles to the direction of, and facing, the traffic that they are intended to serve.

661.4.2.1-Multi-lane Roadways: Signs on the thru roadway and on ramp entrances and exits at the thru roadway shall have the following clearance from the roadway:

In ground installations, the signs shall be erected at a height, measured from the edge of the pavement to the bottom of the sign, as indicated in the following table, unless otherwise specified on the Plans. If, however, a secondary sign is mounted below a guide sign, the major sign shall be at least 8 feet (2.4 m) and the secondary sign at least 5 feet (1.5 m) above the level of the pavement edge unless otherwise specified on the Plans.

SIGNS	HEIGHT (Ft)(m)	MEASURED TO
Route Marker Assemblies	7 (2.1 m)	Bottom of Lowest Sign
Regulatory Signs	7 (2.1 m)	Bottom of Sign
Warning Signs	7 (2.1 m)	Bottom of Sign
Truck Weight Station Signs	7 (2.1 m)	Bottom of Sign
All other signs	7 (2.1 m)	Bottom of Sign

661.4.2.2

Overhead signs shall provide a clearance of not less than17 ft. (5.2) over the entire width of the pavement and shoulders.

For roadways with no curbs or mountable curbs, the minimum horizontal clearance to any roadside sign or overhead sign structure shall be 4 feet (1.2 m) beyond the edge of the paved roadway shoulder, to either the right or left. Where there is an unmountable curb or guardrail, the horizontal clearance shall be at least 2 feet (600 mm) beyond the face of the curb or guardrail.

Mileposts shall be located in line with delineators and at a height of4 ½ ft. (1.350 m), measured between the grade of the pavement and the bottom of the sign panel.

661.4.2.2-Other Roadways: Signs on frontage roads, roads or streets affording access to the multi-lane roadway, and on ramps (other than at the multi-lane roadway) shall have the following clearance from the roadway.

The bottom of the roadside signs shall be 7 feet (2.1 m) above the level of the roadway edge. If however, a secondary sign is mounted below the major sign, the secondary sign shall be at least 6 feet (2.1 m) above the level of the pavement edge.

When signs are placed over the pavement, a clearance of17 ft. (5.2) shall be provided between the surface of the pavement and the bottom of the lowest part of the sign structure.

Roadside signs and overhead structures shall be placed at the edge of the road shoulders and normally shall have a horizontal clearance of two to twelve feet (0.6 to 3.6 m) beyond the edge of the pavement or travelway, except where conditions do not permit, or where otherwise shown on the Plans. Where a raised curb, guardrail, or paved shoulder is present, a sign shall ordinarily be placed with its nearest edge at least 2 feet (0.6 m) outside such curb line, guardrail, or paved shoulder.

661.4.3-Location of Delineators: The reflective units of the delineators shall be positioned to be clearly visible for a distance of 1,000 ft. (300 m) wherever possible during night time under normal weather and atmospheric conditions when illuminated by the upper beam of standard automobile headlights with the vehicle located in the right hand traffic lane approaching the delineator.

Reflective units shall be attached with aluminum rivets of suitable length as follows:

i. One white unit shall be attached to posts or brackets located along the right side of the main roadway.
ii. One white unit shall be attached to posts or brackets along the right of the main roadway through interchange areas and on the right side of the connecting roadways and ramps through the interchange area.
iii. One amber unit shall be attached to posts or brackets along the left side of the connecting roadways and ramps as necessary through the interchange area.

iv. Two white units shall be attached vertically to all posts along the right side on acceleration and deceleration lanes.

v. Two amber units shall be attached vertically on each face of posts or brackets located in the center of dividers less than 8 feet (2.4 m) in width on ramps.

Post mounted delineators shall be supported by flanged channel bar posts of the material, design, and dimensions specified in 657.

When the required longitudinal spacing of posts falls on a structure, delineator brackets, Type A, Type B, or Type C shall be installed instead of a post as shown on the Standard Drawings. Bracket mounted delineators shall be supported on aluminum or steel brackets of the materials, design, and dimensions in accordance with these Specifications and the Standard Drawings. Type A delineator brackets shall be used on bridge railing with horizontal members having a round section. Type B delineator brackets shall be used on bridge railing with horizontal members having a rectangular section. Type C delineator brackets shall be used on bridges having no horizontal bridge rail members.

When the delineators are located above the top rail, the bracket shall be mounted on the fascia side of the railing. The required height of the top of the bracket shall be measured from the surface of the roadway at the edges of the traveled lane as projected from the adjacent fill sections, or as indicated by the pavement edge markings. Brackets shall be fastened to the member of the bridge rail by means of a stainless steel band and hardware as indicated on the Standard Drawings.

Delineators, three per unit or nine per unit, shall be attached as shown on the Standard Drawings to the post at the approach end of channelizing islands within the roadway or at other locations as designated by the Engineer.

661.4.4-Attaching Sign Panels:

i. Flat sheet: Flat sheet signs shall be attached to supports, after the supports are erected, using a nylon washer and a flat steel washer between the sign face and bolt head, a lock washer between U channel posts and nuts as shown on the Standard Drawings. Bolts, nuts and flat and lock washers shall be cadmium plated.

ii. Extruded Panel: After the supports are firmly set, the signs shall be mounted as shown on the Standard Drawings and Plans or as recommended by the manufacturer of the panels. All panels shall be horizontal, the faces shall be flush within commercial tolerances, and the face of the sign shall be flat. All hardware used in erection of the sign shall conform to the Standard Drawings and these Specifications. Any appreciable buckling, warping, or other defects in the panels shall be cause for rejection of the entire sign.

661.4.5-Final Clean Up: Before final inspection, the Contractor shall perform any touching up on paint finishes, cleaning of exposed sign and support surfaces, and leveling and repair of the site as may be deemed necessary by the Engineer to insure the effectiveness and neat appearance of the work.

661.5-METHOD OF MEASUREMENT:

661.5.1-Signs: Measurement for payment for all types of signs will be based on the area in square feet (meters) of the sign faces. Areas shall be calculated to the nearest 0.01 sq. ft. (m) for each sign and to the nearest square foot (m) for the total quantity. The area of any sign shall be the area of the smallest rectangular, triangular or trapezoidal shape that will encompass the entire sign; except for extruded panel signs, which shall have an area equal to the smallest combination of rectangular, triangular, or trapezoidal shapes that constitute the sign.

661.5.2-Delineators: Measurement for payment for delineators will be based on the actual number of delineators necessary to complete the work.

661.5.3-Delineator Brackets: Measurement for payment for delineator brackets will be based on the actual number of delineator brackets necessary to complete the work.

661.5.4-Installation of Reusable Signs: Measurement for payment for installation of reusable signs will be based on the actual number of reusable signs that are designated on the Plans, and are necessary to complete the work. This quantity, shall be plan quantity, unless the Engineer determines the plan quantity to be in error and changes the quantity of reusable signs to be installed.

661.6-BASIS OF PAYMENT:

The quantities, determined as provided above, shall be paid for at the contract unit price for the items listed below, which prices and payments shall be full compensation for furnishing all the materials and doing all work prescribed in a workmanlike and acceptable manner, including all tools, equipment, supplies, and incidentals necessary to complete the work. All incidental work and materials for which no basis of payment is provided will be considered as completely covered by the prices bid for the items included in the Contract.

661.6.1-Signs: Payment will be made at the contract unit price per square foot (m) of sign for the appropriate type of sign. This price shall be full compensation for fabricating, furnishing, and attaching the sign or sign assembly to the post or posts as shown on the Plans or specified. It shall include the furnishing of the aluminum sign panels; all framing, bracing, attachment, and connections necessary to attach the signs to the supports; furnishing and applying the reflective sheeting, or other sign facing material;

furnishing and applying the demountable copy or the process material and screens for screening the legend and border to the sign face as required by the Plans; furnishing all hardware required for the above; and all labor, equipment, tools, and incidentals necessary to complete the work. This item does not include posts.

661.6.2-Delineators: Payment will be made at the contract unit price per reflective unit for each color actually installed. The price shall include fabrication, furnishing and installing the reflective unit, suitable length aluminum rivets, aluminum rivet collar, and all other material, labor, equipment, and tools necessary to complete the installation. This item does not include the post or Type A, Type B, or Type C brackets.

661.6.3-Delineator Brackets: Payment will be made at the contract unit price per bracket for each type actually installed, which price shall include the fabrication, furnishing and installing of the bracket, all necessary hardware and all other materials, equipment, labor and tools necessary to complete the installation.

661.6.4-Installation of Reusable Signs: Payment will be made at the contract unit price per installation of reusable sign. This price shall be full compensation for transporting the sign to the nearest possible location shown on the Plans and erection of the sign, including furnishing the necessary hardware and all other material, labor, equipment and tools necessary to complete the installation.

661.7-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
661001-*	"size" FLAT SHEET SIGN	SQUARE FOOT (METER)
661002-*	EXTRUDED PANEL SIGN	SQUARE FOOT (METER)
661004-*	DELINEATOR, REFLEX REFLECTOR, SINGLE,	EACH
661004-*	DELINEATOR, ENCAPSULATED LENS, SINGLE,	EACH
661005-*	DELINEATOR, REFLEX REFLECTOR, SINGLE,	EACH
661005-*	DELINEATOR, ENCAPSULATED LENS, SINGLE,	EACH
661006-*	DELINEATOR, NINE PER UNIT,	UNIT
661007-*	DELINEATOR, THREE PER UNIT,	UNIT
661008-*	DELINEATOR BRACKET, TYPE "type"	EACH
661011-*	INSTALLATION OF REUSABLE SIGN	EACH

* Sequence number